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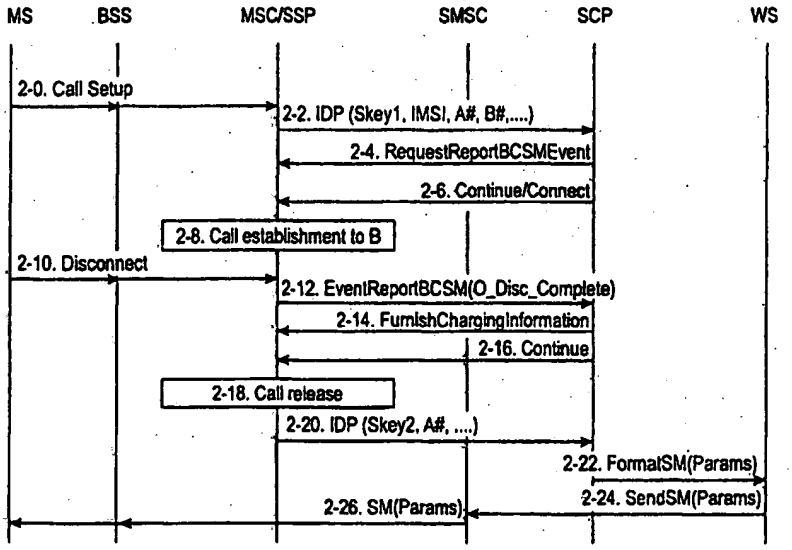
(54) Title: REPORTING CREDIT/CHARGING INFORMATION TO A MOBILE SUBSCRIBER



(57) Abstract

A method for transmitting prepaid charging/credit information to a mobile station (MS). The available credit information can be sent to the mobile station by detecting a termination (2–10) of a call chargeable to the subscriber of the mobile station (MS); and in response to the detecting, sending the credit information to the mobile station (MS) as a connectionless message (2–26), preferably as a short message or a USSD message. Optionally, resources allocated to the call are released (2–18) with sufficient delay for sending the connectionless message without paging the mobile station (MS) separately.

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Reporting credit/charging information to a mobile subscriber

Background of the invention

The invention relates to methods and equipment for reporting charging information to mobile subscribers, including, for example reporting the amount of available credit to prepaid subscribers. In mobile communications systems, such as GSM, the use of prepaid SIM (Subscriber Identity Module) cards is increasing. Prepaid SIM cards relieve the network operators of credit losses. They enable parents to set an upper limit for the telephone bill of their children beforehand. As a third benefit, they enable roaming subscribers to pay their local calls with local tariffs, whereas the use of the SIM card of their home operator results in paying international tariffs to their home network and back.

A problem with prepaid SIM cards is that current mobile stations (handsets) are not provided with means for automatically displaying credit-related information, such as the current credit status, immediately after the end of a call. Some operators allow the subscribers to call an Interactive Voice Response (IVR) service which reports the available credit by synthesized speech. Such a service causes another problem: using the IVR causes a significant amount of overhead traffic in the radio interface. This non-chargeable traffic consumes resources which could be better spent on chargeable calls.

Disclosure of the invention

An object of the invention is to provide a mechanism for reporting the available credit status for prepaid subscribers in a way which allows reducing the overhead traffic load in the radio interface. To discourage users from calling the IVR, the mechanism according to the invention must be fast enough, so that the users will not experience annoying delays. These objects are achieved with a method and equipment which are characterized by what is disclosed in the attached independent claims. Preferred embodiments of the invention are disclosed in the attached dependent claims.

According to one embodiment, at call termination, a service logic program (SLP) handling the call in a Service Control Point (SCP) sends the credit information (e.g. via a LAN connection) to a program running on a separate processor or workstation WS. This program then reformats and passes on the information (e.g. via another LAN) to the Short Message Service Center (SMSC), which sends the actual short message to the mobile station. The LAN

connections can be standard TCP/IP connections. The protocol between the SCP and the workstation can be a specific protocol which is used via an Applications Programming Interface (API). The protocol used between the WS and e.g. Nokia's SMSC is called Computer Interface to Message Distribution-2 (CIMD-2). The program running on the workstation is typically written in C++. To use the API, the programmer has to insert statements in the Service Logic Program (SLP) and write a separate C++ program for receiving the information. CIMD-2 is a simple character based protocol, where a client process makes requests to the server and the server responds.

The basic idea behind the solution is to utilise both the above-mentioned interfaces to make a direct connection from the SCP to the SMSC, thus reducing the time delay from the termination of the call to the time the information is sent as an SMS. This short time is the main advantage of this solution, and experiments performed by the inventor in a test platform have shown that the mobile station can receive the short message in 1 to 5 seconds from the termination of the call.

Optionally, releasing the call will be delayed whereby the message according to the invention can be delivered without a separate page message.

Preferably, the information is extracted from the SCP, because no problems due to propagation delay arise. The SLPs (Service Logic Programs handling the calls) being executed on the SCP provide functionality for communicating with an external process through a gateway between services running inside the Service Logic Execution Environment (SLEE) and external applications. More specifically, the SLPs can send messages to an external process via a socket. The external process runs on a separate computer or workstation, and therefore it does not influence the performance of the SCP. The SLP handling a prepaid call runs during the whole call, since it controls credit updating. This means it will know when the call has finished. The information needed by the external process could then be sent out by adding some SLP code at the end of the prepaid SLP.

Yet another solution is to use the SS7 network for sending the information between the SCP and the SMSC. This solution apparently requires the use of the MAP protocol. As an advantage, no new elements (network connections, programs) would be introduced.

Brief description of the drawings

The invention will be described in more detail by means of preferred embodiments with reference to the appended drawing wherein:

Fig. 1 is a block diagram of a mobile communications network equipped with an arrangement according to a preferred embodiment of the invention;

Fig. 2 is a signalling diagram illustrating one embodiment of the invention; and

Fig 3 depicts a mobile station after receiving and displaying a short message according to the invention.

Detailed description of the invention

Fig. 1 is a block diagram of a mobile communications network equipped with an arrangement according to a preferred embodiment of the invention. This embodiment makes use of Intelligent Network technology. An intelligent network (IN) is able to provide a subscriber of a telecommunications network, such as a wired network or a mobile telephone network, with a plurality of various services. Such services include a virtual private network (VPN) which allows the use of short numbers between subscribers belonging to a local network, and a personal number in which the intelligent network reroutes the calls directed to a personal number in a manner controlled by the subscriber. An example of such an intelligent network is described in recommendations of the ITU-T Q-1200 series, of which Q-1210 to Q-1219 define a set of features known as CS-1 (Capability Set 1), and correspondingly, Q-1220 to Q-1229 define a set of features CS-2. The invention and its background will be described by the terminology of recommendation ETS 300 374-1 CorelNAP, but the invention can also be employed in intelligent networks implemented according to other intelligent network standards.

A basic call state model (BCSM), defined in connection with the intelligent network, describes different stages of call control and defines the points in which call control can be interrupted in order to start an intelligent network service. It identifies the detection points in the call and connection process in which service logic entities of the intelligent network can have an interactive relationship with basic call and connection management features.

In conventional call set-up which takes place without the help of an intelligent network, telephone exchanges make independently all the deduc-

tions about call routing. One or more service control functions (SCF) are associated with intelligent network architecture. The equipment or network element carrying out the tasks determined for the SCF is called a service control point (SCP). In the present invention, the SCF and the SCP are equal, and will hereinafter be called the SCP. The SCP gives call set-up instructions to the exchange, or the exchange may inquire call set-up instructions from the SCP. If the interface of subscriber B is found to be busy at some stage of call set-up, for example, the call can be directed to an alternative number. Service data function SDF and service data point SDP form a database comprising subscriber-specific and/or service-specific information.

A service switching function (SSF) is an interface between the call control function CCF and the service control function SCF. The network element performing the SSF is called a service switching point (SSP). An intelligent network service is produced by the service switching point SSP inquiring instructions from the service control point SCP by means of messages to be transmitted across the SSP/SCP interface upon the encounter of detection points associated with the services. In intelligent network terminology these messages are called operations. In association with an intelligent network service, a service program is started at the service control point SCP, the operation of the program determining the operations transmitted by the SCP to the SSP at each stage of a call.

Fig. 2 is a signalling diagram illustrating a preferred embodiment of the invention. The scenario shown in Fig. 2 begins in step 2-0 wherein the MS sends CALL SETUP signalling to the MSC. In this example, it will be assumed that call establishment takes place under IN control, but this is not necessary to the invention. Another assumption, made here, is that the IN is also responsible for keeping track of the available credit of the prepaid SIM card. In step 2-2, the MSC sends the SCP an INITIAL DETECTION POINT (IDP) message, the parameters of which comprise a Service key Skey1 and the calling and called party numbers A# and B#. Service key Skey1 identifies the IN service in question. In step 2-4, the SCP sends the MSC a REQUESTREPORTBCSMEVENT message, indicating which detection points the MSC must report to the SCP. One such interesting detection point is the one that concerns termination of calls. In step 2-6, the SCP sends the MSC a CONTINUE message which directs the MSC to route the call normally. (Alternatively, the SCP might send a CONNECT message indicating an alternative number, but such variations are

irrelevant to understanding the actual invention.) Step 2-8 comprises all the necessary steps for call establishment to the called party B. For clarity, such routine steps are not shown separately. In step 2-10, the MS terminates the call by sending a DISCONNECT message. In step 2-12, the MSC sends the SCP an EVENTREPORTBCSM message indicating disconnection from the originating side. In step 2-14 the SCP returns a FURNISHCHARGINGINFORMATION message to the MSC. In response to the CONTINUE message in step 2-16, the MSC releases the resources allocated to the call in step 2-18. Again, such routine steps are not shown separately.

According to one embodiment of the invention, in step 2-20, the MSC sends the SCP a second IDP message, having as its parameters a second Service key (Skey2) and the calling party number A#. Service key Skey2 identifies the supplementary service which indicates the available credit to the prepaid subscriber. The next two steps make use of a separate workstation WS, although these steps could also be implemented by means of a process being executed in the SCP. Next, in step 2-22, the SCP sends the WS a message requesting the WS to format a short message indicating the credit information. Preferably, the credit information comprises the duration and price of the last call, and the amount and lifetime of available credit. In step 2-24 the WS sends this information to the Short Message Service Center SMSC, which, in step 2-26 sends it to the MS in a suitably formatted short message.

Fig. 3 shows a mobile station MS after it has received and displayed the short message of step 2-24. In a bilingual or multilingual country like Finland or Switzerland, the workstation SW might make use of the subscriber's language (stored in the HLR) and format the message accordingly.

Based on the above example, several variations will be obvious to a skilled reader. For example, it was assumed that the SCP takes care of both call processing and keeping track of the available credit of the prepaid SIM card, and that the SCP stores the available credit to an IN database called Service Data Point (SDP, not shown separately). This is why the available credit did not have to be transferred to the SCP at the beginning of the call. Of course, keeping track of the available credit can take place in the MSC, whereby the IN call control (steps 2-2 to 2-6 and 2-12 to 2-16) is unnecessary. Alternatively, the SCP could perform call control but the MSC might keep track of the prepaid credit. In this case, only step 2-14 is unnecessary.

As a yet further alternative, the IN call control and the credit reporting according to the invention could be integrated so that sending the CONTINUE message to the MSC in step 2-16 would also trigger sending the FORMATSHORTMESSAGE message to the WS in step 2-22. In other words, the message in step 2-20 is unnecessary. However, for reasons of compatibility with different implementation options, in the example shown in Fig. 2, the SCP reports the credit information to the MSC in step 2-14, and the MSC returns the credit information back to the SCP in step 2-20. In this way, the credit reporting service according to the invention (steps 2-20 to 2-26) is compatible with all combinations of call control and credit tracking under the MSC or the SCP.

Although sending the credit information as a short message is considered the best mode, other transmission channels could be used. A possible alternative transmission method is the use of USSD (Unstructured Supplementary Service Data), which is defined in references 2 to 4. However, network-initiated USSD is only possible with Phase-2 mobile stations. Short message transmission and USSD transmission can be commonly referred to as connectionless transmissions because the information is simply transmitted to the recipient, without the establishment of an end-to-end connection.

The invention can be used for transmitting any kind of credit/charging information the transmission of which is triggered in response to ending a call. Preferably, the credit/charging information comprises the current credit status, the duration of the last call, the price of the last call and the validity period of the SIM card. Although the invention has been described in connection with prepaid subscriptions, it is not a strict requirement that the subscription is prepaid. As an alternative, subscribers may wish to set an upper limit for the monthly telephone bill. Thus, even if a mobile telephone is stolen, the amount of damage could be restricted to the predefined upper limit, and parents can set an upper limit to the monthly telephone bill of their children. The invention is equally suitable for transmitting the available charging limit (the predefined upper limit minus the accumulated, but not yet invoiced, charge).

References:

1. GSM 02.90: European digital cellular telecommunications system (Phase 2); Stage 1 description of Unstructured Supplementary Service Data (USSD)

2. GSM 03.90: Digital cellular telecommunications system (Phase 2); Unstructured Supplementary Service Data (USSD) - Stage 2
3. GSM 04.90: European digital cellular telecommunications system (Phase 2); Unstructured Supplementary Service Data (USSD) - Stage 3

All references are incorporated herein by reference.

Claims

1. A method for transmitting credit/charging information to a mobile station (MS);

characterized in that the method comprises the steps of:

detecting a termination (2-10) of a call chargeable to the subscriber of the mobile station (MS);

in response to said detecting, sending said credit/charging information to the mobile station (MS) as a connectionless message (2-26).

2. A method according to claim 1, characterized in that the method further comprises the steps of:

defining an upper limit for the accumulated price of telephone calls;

monitoring the accumulated price of telephone calls;

allowing a new call only if the accumulated price of telephone calls is less than the upper limit.

3. A method according to any of the preceding claims, characterized in that said connectionless message is a short message.

4. A method according to any of the preceding claims, characterized in that said connectionless message is a USSD message.

5. A method according to any of the preceding claims, characterized in that after detecting said termination (2-10) of the call, releasing the call (2-18) with sufficient delay for sending said connectionless message without paging the mobile station (MS) separately.

6. A method according to any of the preceding claims, characterized in that an Intelligent Network node, preferably a Service Control Point (SCP):

requests (2-4) a Mobile Services Switching Centre (MSC) to report said termination of call; and

in response to said reporting (2-12), initiates (2-16, 2-22) said sending of said credit/charging information.

7. A method according to claim 6, characterized in that

sending said credit/charging information is triggered by a Service Logic Program being executed in a Service Logic Execution Environment (SLEE) in the Service Control Point (SCP);

the Service Logic Program provides functionality for communicating with an external process through a gateway between services running inside the Service Logic Execution Environment (SLEE) and an external application (WS); and

the credit/charging information is sent using the gateway to the external application (WS) which sends it to the mobile station (MS).

8. An arrangement (SCP, WS) for transmitting credit/charging information to a mobile station (MS) in a mobile telecommunications network;

characterized in that the arrangement (SCP, WS) is adapted to:

detect a termination (2-10) of a call chargeable to the subscriber of the mobile station (MS); and

in response to said detecting, send said credit/charging information to the mobile station (MS) as a connectionless message (2-26).

9. An arrangement according to claim 8, characterized in that the arrangement comprises a Service Control Point (SCP) of an Intelligent Network, said Service Control Point comprising a Service Logic Program for sending said credit/charging information in response to said detecting.

10. An arrangement according to claim 9, characterized in that the arrangement further comprises a separate processor (WS) for formatting said credit/charging information.

Fig. 1

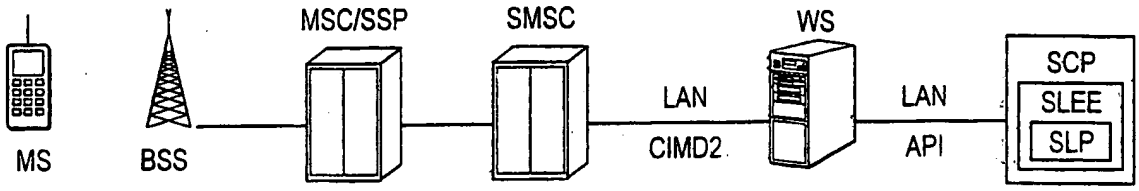


Fig. 2

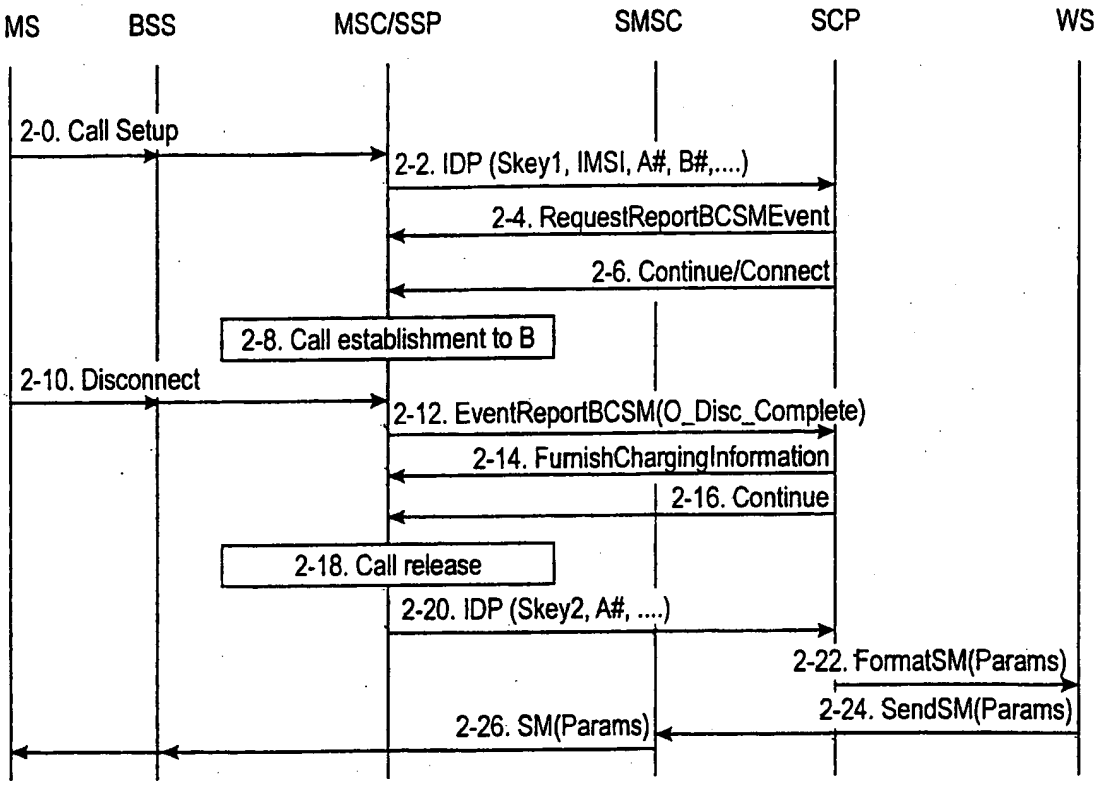
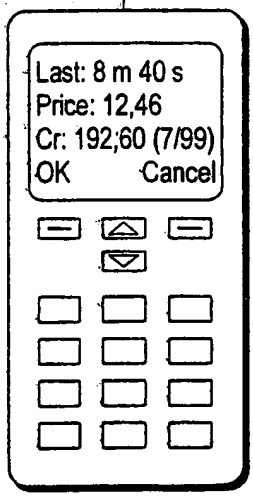


Fig. 3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00796

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04M 15/00, H04Q 7/22 // H04Q 7/38
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0647055 A1 (AT & T CORP.), 5 April 1995 (05.04.95), column 4, line 47 - line 50; column 6, line 23 - line 29, figure 3, abstract --	1-10
A	WO 9742772 A1 (ERICSSON INC.), 13 November 1997 (13.11.97), page 3, line 1 - line 14, figures 2,3, 5, abstract --	1-10
A	WO 9320644 A1 (MOTOROLA LIMITED), 14 October 1993 (14.10.93), abstract --	1-10
A	US 5109401 A (HATTORI ET AL), 28 April 1992 (28.04.92), column 1, line 32 - line 39 --	1-10

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

02/12/99

International application No.
PCT/FI 99/00796

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